9/27/17
"What you do today can improve all your tomorrows"-Ralph Marston

HW: "Difference Quotient" worksheet #1-4

Aim: What is the Difference Quotient?

Warm Up: Which of the following are continuous at $x = 1$?

yes (a) $f(x) = \begin{cases} 5 & x = 1 \\ 2x+3 & x \neq 1 \end{cases}$ → 5, $2(1)+3 \to 5$ same

yes (b) $f(x) = \begin{cases} 4x & x = 1 \\ \frac{2x^2-2}{x-1} & x \neq 1 \end{cases}$

yes (c) $f(x) = \begin{cases} 0 & x = 1 \\ \frac{x-1}{\sqrt{1-x}} & x \neq 1 \end{cases}$

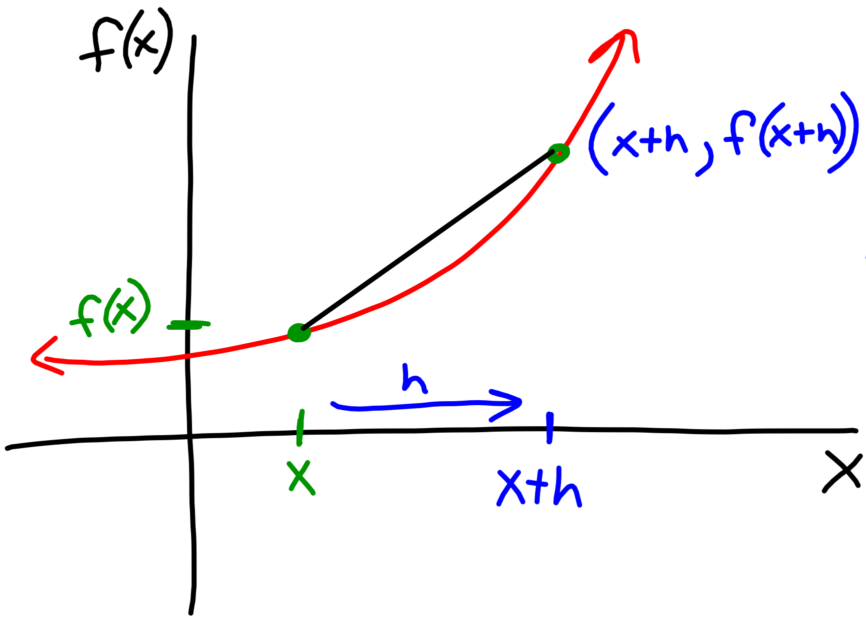
b) $4(1) \to 4$ same

$\frac{2(1)^2-2}{1-1} = \frac{0}{0}$ $\quad \frac{2x^2-2}{x-1} = \frac{2(x^2-1)}{x-1} = \frac{2(x+1)\cancel{(x-1)}}{\cancel{x-1}} = 2(x+1)$

$2(1+1) = 4$

c) $0$ same

$\frac{1-1}{\sqrt{1-1}} = \frac{0}{0}$ $\quad \frac{x-1}{\sqrt{1-x}} \cdot \frac{\sqrt{1-x}}{\sqrt{1-x}} = \frac{\overset{-1}{\cancel{(x-1)}}(\sqrt{1-x})}{\cancel{1-x}} = -\sqrt{1-x} \quad -\sqrt{1-1} = 0$




$$\text{slope} = \frac{f(x+h) - f(x)}{x+h-x}$$

$$= \frac{f(x+h) - f(x)}{h}$$

1. Given $f(x) = 4x^2$, find the following and simplify.

(a). $f(x+h)$

$= 4(x+h)^2$

$= 4(x^2+2xh+h^2)$

$= 4x^2+8xh+4h^2$

(b). $f(x+h) - f(x)$

$= 4x^2+8xh+4h^2 - 4x^2$

$= 8xh+4h^2$

(c). $\dfrac{f(x+h) - f(x)}{h} = \dfrac{8x\cancel{h}+4h^{\cancel{2}}}{\cancel{h}} = \boxed{8x+4h}$

Find $\dfrac{f(x+h)-f(x)}{h}$ for each of the following.

1. $f(x)=x^2-5x-1$

$$\frac{(x+h)^2-5(x+h)-1-(x^2-5x-1)}{h}=\frac{\cancel{x^2}+2xh+h^2\cancel{-5x}-5h\cancel{-1}\cancel{-x^2}\cancel{+5x}\cancel{+1}}{h}$$

$$=\frac{2x\cancel{h}+h^{\cancel{2}}-5\cancel{h}}{\cancel{h}}=\boxed{2x+h-5}$$

2. $f(x)=3x^2-4x$

3. $f(x)=x^3-4x^2+5x$

$$=\frac{(x+h)^3-4(x+h)^2+5(x+h)-x^3+4x^2-5x}{h}$$

$$=\frac{\cancel{x^3}+3x^2h+3xh^2+h^3\cancel{-4x^2}-8xh-4h^2\cancel{+5x}+5h\cancel{-x^3}\cancel{+4x^2}\cancel{-5x}}{h}$$

$$=\frac{3x^2\cancel{h}+3xh^{\cancel{2}}+h^{\cancel{3}}-8x\cancel{h}-4h^{\cancel{2}}+5\cancel{h}}{\cancel{h}}$$

$$=\boxed{3x^2+3xh+h^2-8x-4h+5}$$

4. $f(x)=\dfrac{1}{x}$

$$\frac{x(x+h)\,\frac{1}{x+h}-\frac{1}{x}\,x(x+h)}{h\,x(x+h)}=\frac{x-(x+h)}{hx(x+h)}=\frac{x-x-h}{hx(x+h)}=\frac{-\cancel{h}}{\cancel{h}x(x+h)}$$

$$\frac{-1}{x(x+h)}$$